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OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

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**MEMORANDUM**

**SUBJECT:** **Cyhalofop-butyl:** Drinking Water Exposure Assessment for Proposed Section 3 Label Amendments for Clincher® GR and Clincher® Granule Uses on Rice Grown in California

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The attachment to this memorandum is the drinking water exposure assessment in response to a request from Dow Agrosciences LLC for supplemental labeling of cyhalofop-butyl. The registrant proposes to increase the maximum single application rate from 0.288 lbs. active ingredient (a.i.) per acre to 0.36 lbs. a.i. per acre. The proposed supplemental label would be applied to the end-user products Clincher® GR (EPA Reg. No. 62719-613; 1.8% a.i.), and Clincher® Granule (EPA Reg. No. 62719-647, 3.6% a.i.) for postflood, postemergence use on grass weeds in water-seeded rice production in the State of California.

The proposed label amendments result in lower chronic exposure estimates (61 µg/l) than that from currently labeled use patterns (76 µg/l) for use in the human health dietary risk assessment. However, both the 76 µg/L and 61 µg/L EDWCs are higher than previous recommendations. Questions related to this assessment can be directed to Richard Shamblen, (703) 305-7091 (shamblen.richard@epa.gov).

Attachment:
*Drinking Water Exposure Assessment for Section 3 Label Amendments for Cyhalofop-butyl Use on Rice in California*

2087080

# Drinking Water Exposure Assessment for Section 3 Label Amendments for Cyhalofop-butyl Use on Rice in California

**March 30, 2012**

## 1.0 Executive Summary

*Assessment Findings*

- The estimated drinking water concentration (EDWC) chronic exposure for cyhalofop-butyl in surface water will increase from 21 ug/l to 76 ug/l (recommended EDWCs are in Table 1-1).

- The registrant's proposed supplemental label request to increase cyhalofop-butyl's maximum single application rate to 0.36 lbs active ingredient (a.i.)/ A/ year will decrease the EDWCs chronic exposure when compared to the currently registered sequential (*i.e.* split) application program with a maximum rate of 0.495 lbs a.i./ A/ year. The proposed supplemental label would reduce the EDWC chronic exposure 19% from 76 ug/l to 61 ug/l.

*Proposed Use*

Pursuant to a Pesticide Registration Improvement Renewal Act (PRIA 2) action R350, Dow Agrosciences LLC is seeking a Section 3 label amendment for cyhalofop-butyl (butyl (R)-2-[4-(4-cyano-2- fluorophenoxy)phenoxy]propionate; PC Code 082583; CAS Number 122008-85-9). The registrant proposes to increase the maximum single application rate from 0.288 lbs. active ingredient (a.i.) per acre (up to 0.495 lbs a.i./year) to only one maximum application rate of 0.36 lbs. a.i. per acre per year. Cyhalofop-butyl is the active ingredient in registered formulated products as a postflood and postemergence selective herbicide for the control of grass weeds in water-seeded rice production in the state of California. The proposed label amendment would supplement the labels for the products Clincher® GR (EPA Reg. No. 62719-613; 1.8% a.i.), and Clincher® Granule (EPA Reg. No. 62719-647; 3.6% a.i.). The proposed supplemental label registration does not include Clincher® CA (EPA Reg. No. 62719-356; 29.6% a.i.).

The proposed supplemental label for Clincher® GR enables users to select either:

1) sequential applications: maximum single application rate of 0.288 lbs a.i./A and a maximum annual application rate 0.495 lbs a.i./A, with a maximum of two applications per year that must be applied at least ten days apart; or,
2) a single application limited to a maximum annual rate of 0.36 lbs. a.i./A.

Similarly, the proposed supplemental label for Clincher® Granule would allow users to select either:

1) sequential applications: maximum single application rate of 0.288 lbs a.i./A, and a maximum annual application rate 0.495 lbs a.i./A, or an additional application rate of

Clincher® CA at 0.186 lbs a.i./A with a maximum of two applications per year that must be applied at least ten days apart; or,

2) a single application limited to a maximum annual rate of 0.36 lbs. a.i./ A.

*Product Label Discrepancy*

A product label discrepancy with inconsistent maximum annual application rates has been identified on Clincher® GR and Granule product labels, and is evident in Table 3-1. When applying either Clincher® products sequentially (*i.e.* split applications), both labels allow application rates that can be as high as 0.495 lbs a.i./A per year. Yet, both labels concurrently state that no more than 0.47 lbs of the active ingredient can be applied per acre per year from any registered product containing cyhalofop-butyl. Only the registered, optional split application of Clincher® Granule followed by Clincher® CA results in a total maximum application rate of 0.47 lbs a.i./A per year.

*Results*

This drinking water exposure assessment is an abbreviated assessment that relies upon technical analyses and literature reviewed during the previous drinking water assessment completed in 2008 (EPA, 2008). Results of this screening-level drinking water exposure assessment include estimated drinking water concentrations (EDWC) of cyhalofop-butyl for use in the human health dietary risk assessment. To account for known and unknown data gaps and model uncertainties, multiple conservative assumptions were incorporated into the model analysis. The Tier I Rice model was modified to account for pesticide degradation and calculate chronic and acute drinking water exposure concentrations.

*Surface Water Modeling*

Results of the modified Tier I Rice model estimated drinking water concentrations (EDWCs) of cyhalofop-butyl in surface water for the Clincher® GR and Clincher® Granule products registered for use in rice paddies are summarized Table 1-1. Model results are not adjusted with percent cropped area (PCA) factors, in accordance with current divisional guidance (USEPA, 2012). Conservative estimates for acute (peak concentration) exposure to cyhalofop-butyl from the proposed higher total annual single application is predicted to be 363 µg/l. This is 20.2% lower than that from the currently labeled sequential (*i.e.* split) application method. Similarly, chronic exposure (annual mean concentration) is estimated to be 61 µg/l. Since the registered products Clincher® GR and Clincher® Granule will retain the sequential application option in the state of California, the chronic EDWC of 76 µg/l is the maximum chronic exposure estimate for use in the human health dietary risk assessment.

**Table 1-1. Estimated drinking water concentrations (EDWCs) of cyhalofop-butyl in surface water for existing labels and the proposed supplemental labels for Clincher® GR and Clincher® Granule in the state of California.**

| Product Labels: Clincher® GR Clincher® Granule | Application Method | Maximum Application Rate(s) (lbs a.i. /A) | Estimated Drinking Water Concentrations (EDWCs) (µg/l) | |
|---|---|---|---|---|
| | | | Acute[2] | Chronic[3] |
| Existing Label | Sequential Applications[1] | Single Maximum: 0.288<br>Annual Maximum: 0.495 | **455** | **76** |
| | Single Application | Single & Annual Maximum: 0.288 | **291** | **48** |
| Proposed Supplemental Label | Single Application | Single & Annual Maximum: 0.36 | **363** | **61** |

Abbreviations: lbs = pounds; A = acre; a.i. = active ingredient

1 In this scenario, a minimum application interval of 10-days is required on the label.

2 Highest estimated single-day concentration occurring the day of final product application.

3 This was calculated as the average concentration of 365 days following the second application.

*Ground Water Modeling*

Contamination risk of cyhalofop-butyl to ground water was determined to be low in two previous drinking water exposure assessments. The Screening Concentration in Ground Water (SCIGROW) model was not used during this assessment since the proposed total annual application rates are less than the currently registered label application rates. Previous SCIGROW model results in both 2001 and 2008 drinking water exposure assessments were 0.16 and 0.152 µg/l, respectively (USEPA, 2001a and USEPA, 2008).

*Water Quality Monitoring Data*

Publicly available water quality monitoring data were evaluated for detections of cyhalofop-butyl in ground water, surface water and public drinking water supplies. Similar to the 2008 assessment, an evaluation of publicly available water quality monitoring data reveal no detections.

## 2.0 Problem Formulation

The Tier I drinking water exposure assessment uses models and publicly available water quality monitoring data to estimate and identify pesticide residues of concern in ground and surface waters that might be used as a drinking water source. This initial assessment identifies the risk

of pesticides exposure in drinking water supplies , and provides estimated drinking water concentrations (EDWC) for the human health dietary risk assessment.

Cyhalofop-butyl, cyhalofop-acid, and cyhalofop-diacid are the identified residues of concern for drinking water (EPA, 2001b). Drinking water treatment technology provides limited removal of pesticide residues (USEPA, 2001b).

## 3.0 Use Characterization

Clincher® GR and Clincher® Granule are postflood and postemergence selective herbicide products containing the active ingredient cyhalofop-butyl for the control of grass weeds in water-seeded rice, and registered for use only in the State of California. Both herbicide products are applied directly onto flooded rice fields when grass weeds are at the 1 to 4 leaf stage and 70 to 100% submerged with a water depth of 2 to 5 inches. Only grass weeds emerged and growing under flooded rice field conditions at the time of application are controlled.

No more than two applications of any registered products containing cyhalofop-butyl can be applied to the same field in the same year and must be applied up to 60 days before harvest. On both Clincher® GR and Clincher® Granule labels, the registrant recommends the user maintain a 7-day "static" retention period after application in the flooded rice paddy. Moreover, "for best results", both labels recommend a 14-day holding period following the final application before discharging treated paddy water into receiving streams. However, the labels do not require a holding period of any length.

Table 3-1 compares the product's Clincher® GR and Clincher® Granule percent active ingredient (a.i.), existing and proposed application methods, and method application rates. In addition to Clincher® GR's existing product label, the proposed supplemental label would enable users to select either:

1) sequential applications: maximum single application rate of 0.288 lbs a.i./A and a maximum annual application rate 0.495 lbs a.i./A, with a maximum of two applications per year that must be applied at least ten days apart; or,
2) a single application limited to a maximum annual rate of 0.36 lbs. a.i./A.

Similarly, the proposed supplemental label for Clincher® Granule would allow users to select either:

3) sequential applications: maximum single application rate of 0.288 lbs a.i./A, and a maximum annual application rate 0.495 lbs a.i./A, or an additional application rate of 0.186 lbs a.i. Clincher® CA per acre with a maximum of two applications per year that must be applied at least ten days apart; or,
4) a single application limited to a maximum annual rate of 0.36 lbs. a.i./ A.

A maximum annual application rate discrepancy has been identified on Clincher® GR and Granule product labels, and is evident in Table 3-1. When applying either Clincher® products sequentially (*i.e.* split applications), both labels allow seasonal application rates that can be as high as 0.495 lbs a.i./A. Yet, both labels simultaneously state that no more than 0.47 lbs of the

active ingredient can be applied per acre per year from any registered product. Only the sequential application of Clincher® Granule followed by Clincher® CA results in a total maximum annual application rate of 0.47 lbs a.i./A.

**Table 3-1. Characteristics of Clincher® GR and Clincher® Granule application methods and rates for the currently registered and proposed supplemental labels.**

| Registered Product, Percent active ingredient (a.i.) (EPA Registration Number) | Application Method (Label Status) | Maximum Single Application Rate (lbs/A) | | Maximum Secondary Application Rate (lbs/A except where noted) | | Maximum Annual Application Rate (lbs/A except where noted) | | Minimum Application Interval |
|---|---|---|---|---|---|---|---|---|
| | | Product | a.i. | Product | a.i. | Product | a.i. | days |
| Clincher® GR 1.8% a.i. (62710-613) | Sequential (Existing) | 16 | 0.288 | 11.5 | 0.207[1] | 27.5 | 0.495 | 10 |
| | Single (Existing) | 16 | 0.288 | NA | NA | 16 | 0.288 | NA |
| | Single (Proposed Supplemental) | 20 | 0.36 | NA | NA | 20 | 0.36 | NA |
| Clincher® Granule 3.6% a.i. (62710-647) | Sequential (Existing Option A) | 8 | 0.288 | 5.75 | 0.207[1] | 13.75 | 0.495 | 10 |
| | Sequential (Existing Option B[2]) | 8 | 0.288 | 10 fl oz/A | 0.186[3] | 8 lbs *plus* 10 fl oz/A | 0.474[2] | 10 |
| | Single (Existing) | 8 | 0.288 | NA | NA | 8 | 0.288 | NA |
| | Single (Proposed Supplemental) | 10 | 0.36 | NA | NA | 10 | 0.36 | NA |

Abbreviations: NA = not applicable; oz. = ounce; lbs. = pounds; A = Acre; a.i. = active ingredient

1 Calculated, only for sequential applications, as the difference between the maximum annual application rate and maximum single application rate.

2 For Clincher® Granule Option B, the product Clincher® CA is used during the second application. A drinking water assessment of cyhalofop-butyl was completed for the product Clincher® CA (EPA, 2008).

3 Conversion formula from product ounces to pounds of active ingredient: (ounces per A) x 2.38 lbs a.i. per gallon/128 oz per gallon (derived from conversion table on Clincher® CA label).

The proposed supplemental labels include use on rice production in California's three climatic regions: the Sacramento Valley; areas surrounding Clear Lake in Lake County; and the mountain valleys in North-eastern California. Consistent with previous drinking water assessments, rice

production is located in Butte, Colusa, Fresno, Glenn, Merced, Placer, Sacramento, San Joaquin, Stanislaus, Sutter, Tehama, Yolo, and Yuba Counties (USDA, 2010). In California, seeding is generally done in the spring, except in some of the higher elevations, where planting may also occur in the fall. In the Sacramento Valley, annual reseeding in the spring is required because the rice fields do not remain moist over the winter (USEPA, 2008).

## 4.0 Environmental Fate and Transport Characterization

Characteristics of cyhalofop-butyl's physicochemical properties and environmental fate have been well documented in Appendix A of the previous drinking water assessment (USEPA, 2008). Generally, the major degradates (*i.e.*, degradates that form greater than 10% of the applied) in aerobic aquatic metabolism studies include cyhalofop-acid, cyhalofop-amide, and cyhalofop-diacid. The physicochemical properties indicate that these degradates have little tendency to volatilize, or to sorb to soil. The degradates will be quite mobile due to the low soil-water partition coefficient ($K_d$) values. Cyhalofop-butyl residues will likely degrade in the water column with a half-life of 42 days.

## 5.0 Exposure Assessment

This drinking water exposure assessment consists of surface water exposure modeling and an evaluation of publicly available water quality monitoring data of pesticides in surface and ground water resources used for drinking water supplies in the state of California. The Screening Concentration in Ground Water (SCIGROW) model was not used during this assessment since the proposed total annual application rates are less than the currently registered label application rates. Previous SCIGROW model results in both 2001 and 2008 drinking water exposure assessments were 0.16 and 0.152 µg/l, respectively (USEPA, 2001a and USEPA, 2008).

### 5.1 Previous Assessments

A nationwide combined drinking water exposure and ecological risk assessment for rice production was completed in 2001 for cyhalofop-butyl (USEPA, 2001a). The drinking water assessment was completed before the Tier I Rice Model was adopted by the Agency (USEPA, 2007). A hypothetical watershed of flooded rice fields (percent crop area of 87%) was modeled to calculate estimated drinking water concentrations (EDWCs) occurring after discharge of the rice paddy water into a receiving reservoir with 2x dilution.

In 2008, a drinking water assessment for cyhalofop-butyl was completed for the new use on wild rice production in the state of California. To account for aerobic aquatic degradation, the Tier I Rice model was modified to estimate total residues for acute and chronic surface water EDWCs (USEPA, 2008).

Total residues in surface water for acute and chronic exposures were 36 µg/l and 3.7 µg/l in the 2001 assessment. Whereas, in the 2008 drinking water assessment, acute and chronic exposures were calculated to be 279 µg/l and 21 µg/l, respectively. Comparison of the dissipation and degradation model results in 2008 reveal that the pesticide degradation pathway provides a more

conservative, *i.e.* higher, estimate of total residue concentrations in surface waters. Results of the Tier I ground water model SCI-GROW were nearly identical in both assessments for both acute and chronic exposures; 0.152 and 0.16 µg/l.

*Model Error*

In the 2008 drinking water assessment, the authors intended to use an aerobic aquatic metabolism rate constant (k) that represents the upper 90$^{th}$ percentile confidence bound of the mean first order half-lives of total residues (cyhalofop-butyl, cyhalofop-acid, and cyhalofop-diacid). Instead, the lower 10$^{th}$ percentile confidence bound of the mean aerobic aquatic metabolism half-life was used. Revised results are presented in Table 5-4.

## 5.2 Exposure Modeling

### 5.2.1 Surface Water

*Tier I Rice Model*

The Environmental Fate and Effects Division (EFED) developed the screening level Tier I Rice model (*i.e.* an equation) to estimate pesticide concentration residues in surface waters of flooded rice fields (USEPA, 2007). The Tier I Rice Model is expressed in the following equation:

Equation 1: $$C_w = m_{ai}' / (0.00105 + 0.00013 \times K_d)$$

where;

$C_w$ = the paddy water concentration (µg/L)
$m_{ai}'$ = the application rate (kg/hectare)
$K_d$ = the soil-water distribution coefficient in L/kg

*Tier I Rice Model Modified with Aerobic Aquatic Degradation*

The Tier I Rice Model was provisionally modified to estimate pesticide residues in surface water discharged from rice fields (*e.g.* tail water) following a retention period and allowing aerobic aquatic degradation. Incorporating the aerobic aquatic degradation pathway into the Tier I Rice model was used to identify:

1) acute (peak) concentrations following single, or sequential-applications;
2) acute concentrations after the label "recommended" pesticide retention periods (for either single or sequential application scenarios); and,
3) chronic (annual mean) exposure.

The modified Tier I Rice Model includes the additional equation:

Equation 2: $C_{w,t} = C_{w,0}\, e^{(-kt)}$

where;

Cw, t = the concentration in water at time, t (µg/L)
Cw, 0 = the concentration in water at application or time of zero (µg/L) (calculated using the Tier I Rice Model)
k = the aerobic aquatic metabolism rate constant ($d^{-1}$)
t = days after application (d)

*Model Parameters*

The Tier I Rice Model physical parameters are provided in the guidance document (USEPA, 2007). These physical parameters (*e.g.*, water depth of 10 cm) remained consistent among the 2008, revised 2008, and 2012 drinking water exposure assessments.

The modified Tier I Rice model requires adjustable input parameters that are summarized by drinking water assessment in Table 5-2. The 2008 drinking water assessment for Clincher CA used an incorrect aerobic aquatic metabolism rate constant (k = 0.0384 $d^{-1}$). Therefore, in this assessment, the 2008 drinking water assessment was re-modeled with the correct rate constant (k = 0.0165 $d^{-1}$) in the modified Tier 1 Rice Model.

**Table 5-2. Comparison among drinking water assessments of Tier I Rice Model input parameters used to estimate drinking water concentrations (EDWCs) in California.**

| Model Input Parameter | DWA (2008) | DWA Revised (2008) | Existing Label | Proposed Supplemental (2012) |
|---|---|---|---|---|
| Registered Product | Clincher® CA | Clincher® CA | Clincher® GR Clincher® Granule[3] | Clincher® GR Clincher® Granule |
| Application Method | Sequential[1] | Sequential | Sequential | Single |
| Maximum Application Rates[2] (lbs a.i. /A) | 0.28 followed by 0.18 Maximum Annual: 0.46 | 0.28 followed by 0.18 Maximum Annual: 0.46 | 0.288 followed by 0.207 Maximum Annual: 0.495 | Maximum Annual: 0.36 |
| Soil-Water Distribution Coefficient, $K_d$ (l/kg) | 0.463 | 0.463 | 0.463 | 0.463 |
| Aerobic Aquatic Metabolism $t_{1/2}$ (days) | 42 | 42 | 42 | 42 |
| Aerobic Aquatic Metabolism rate constant, k ($day^{-1}$) | 0.0384 | 0.0165 | 0.0165 | 0.0165 |

Abbreviations: NA = not applicable; DWA = drinking water assessment; kg = kilogram; lbs = pounds; ha = hectare; A = acre; a.i. = active ingredient

1 Sequential refers to the splitting of product applications into two events separated by at least 10 days.
2 Application rates have been rounded to 2 significant digits, except for the existing label for Clincher® GR and Granule. Three significant digits are reported on both Clincher® product labels.
3 Clincher® Granule has the option for sequential application with Clincher® CA, but this is at a lower rate of 0.46 lbs a.i./A/year.

*Assumptions, Data Gaps and Uncertainties*

Assumptions, uncertainties and limitations of the modified Tier I Rice model were fully explored in the model's guidance document (USEPA, 2007) and previous drinking water assessments (USEPA, 2008). To account for known and unknown data gaps and model uncertainties, multiple conservative assumptions were incorporated into the model analysis and includes the following:

1. To address the discrepancy identified on both Clincher® GR and Granule product labels' total annual application limit for sequential applications, a total annual application rate of 0.495 lbs a.i. /A was used instead of 0.47 lbs a.i./acre, which both labels also state is an annual maximum rate);

2. The highest total annual single application rate of 0.36 lbs a.i. / A was used for the proposed supplemental product labels;
3. The total pesticide residue concentration in surface water occurring on the day of product application (*i.e.* day 0) was used to represent the potential for an early release (City of Sacramento, 2012);
4. A 10-cm (4-inch) flood was assumed to be present in the rice paddy. The label recommends flood depths of 2-5 inches. Exposure estimates are more or less conservative when paddy water depths are shallower or deeper, respectively, than 10 cm;
5. A percent cropped area (PCA) adjustment factor was not used. This is consistent with current Agency divisional guidance (USEPA, 2012);
6. The modified Tier I Rice model, or modified version, does not account for all the routes of dissipation for the pesticide, such as all types of pesticide degradation, mass transfer, volatilization, dilution, or other dissipation processes; and,
7. There were no considerations for dilution of the pesticide residues in the receiving stream. Dilution is expected of the tail water into the receiving water body before it reaches drinking water intakes. However, little information is available to estimate the degree of dilution.

***Results***

The modified Tier I Rice model results of existing, revised and proposed supplemental application rate scenarios for registered products containing cyhalofop-butyl are summarized in Table 5-3. Model results were not adjusted with PCA factors, consistent with current Agency divisional guidance (USEPA, 2012).

**Table 5-3. Modified Tier 1 Rice model results.**

| EPA Registration Label Status | Registered Product(s) / Year of DWA | Application Method | Maximum Application Rate(s)[3] (lbs. a.i./A) | Estimated Drinking Water Concentrations (EDWC) (µg/l) | |
|---|---|---|---|---|---|
| | | | | Acute | Chronic[2] |
| Existing | Clincher® CA (2008) | Sequential Applications[1] | 0.28 followed by 0.18; Annual Maximum: 0.46 | **279** | **21** |
| | Revised Clincher® CA (2008) | Sequential Applications | 0.28 followed by 0.18; Annual Maximum: 0.46 | **421** | **70** |
| | Clincher® GR and Clincher® Granule: Option A (2012) | Sequential Applications | 0.288 followed by 0.207; Annual Maximum: 0.495 | **455** | **76** |
| | Clincher® Granule: Option B (2012) | Sequential Applications | 0.288 followed by 0.186; Annual Maximum: 0.465 | **434** | **72** |
| | Clincher® GR and Clincher® Granule: (2012) | Single Application | Annual Maximum: 0.288 | **291** | **48** |
| Proposed Supplemental | Clincher® GR Clincher® Granule (2012) | Single Application | Annual Maximum: 0.36 | **363** | **61** |

Abbreviations: DWA = drinking water assessment; kg = kilogram; ha = hectare; A = acre; a.i. = active ingredient

1. In this scenario, there were two applications with an application interval of ten day based on the minimum application interval specified on the label.
2. This was calculated as the average concentration from the day of application through 365 days.
3. Application rates have been rounded to 2 significant digits, except for the existing label for Clincher® GR and Granule. Three significant digits are reported on both Clincher® product labels.

*Clincher® CA Revision*

Revisions to the 2008 cyhalofop-butyl drinking water assessment for the use in the product Clincher® CA indicates higher chronic exposure estimates. Acute total residue concentrations are 421 µg/l; 142 µg/l higher than previously reported in 2008. Chronic exposure is estimated to be 70 µg/l; 333% higher than reported in the 2008 drinking water assessment.

*Clincher® GR and Clincher® Granule*

Both Clincher® GR and Granule registered products have the option to be applied sequentially (*i.e.* split application) for a total annual application rate of 0.495 lbs a.i. /A. The existing annual maximum single application rate for both registered products is 0.288 lbs a.i. /A. Although the Clincher® Granule has the option to also apply at an overall lower total annual rate of 0.46 lbs /A when it is applied sequentially with Clincher® CA, the higher application rate option is reported for this assessment.

*Sequential Applications*

For either Clincher® GR or Granule (Option A) registered products, the sequential application scenario may yield peak surface water concentrations of 455 µg/L and chronic concentrations from 1.1 – 455 µg/L. The chronic exposure to untreated drinking water of total residues in surface water is estimated to be 76 µg/L.

Chronic exposure in surface waters to Clincher® Granule (Option B) is estimated to be 72 µg/L; 5% less than either Clincher® GR or Granule (Option A).

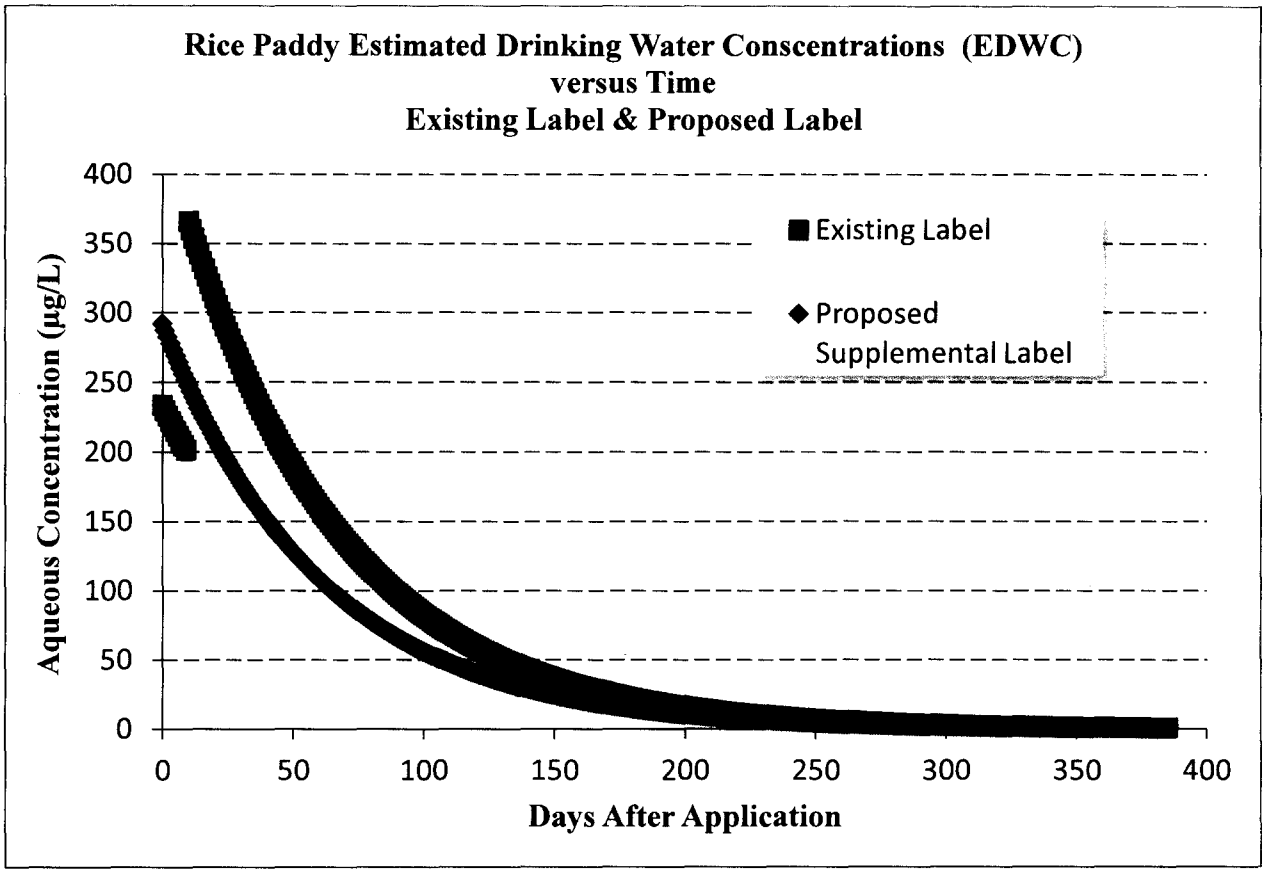
*Proposed Supplemental Label*

For both Clincher® GR and Granule registered products, the higher single application rate scenario may yield peak surface water concentrations of 363 µg/L and chronic surface water concentrations of 61µg/L.

*Comparison of Existing Label and Proposed Supplemental Label Application Rates*

Figure 5-1 illustrates the relationship of total cyhalofop-butyl residues in surface water between the currently labeled sequential application and proposed supplemental single application methods. A sequential application (*i.e.* split application) occurs after 10-days following the initial application in the existing application scenario and is depicted by the separate lines in Figure 5-1. Because of the cumulative concentrations from the sequential application method, the single, but higher, application rate will yield lower acute and chronic total residue concentrations in surface waters.

**Figure 5-1. A comparison of estimated drinking water concentrations (EDWC) from the existing label and proposed supplemental labels for use of cyhalofop-butyl on rice in California.**




*Model Uncertainties*

Label application conditions recommend cyhalofop-butyl containing products to be applied when rice paddy fields are covered with 2 to 5 inches of water. The Tier I Rice model water column depth parameter was set at 0.10 meters (4 inches) for all modeled application scenarios. Table 5– 4 compares the effect of water depth on model results. As expected, as water level decrease, the estimated drinking water concentrations become higher.

**5-4: The effect of varying rice paddy field water depth on EDWC in the modified Tier I Rice model.**

| Rice Paddy Depth[1] | | Chronic[2] Estimated Drinking Water Concentrations (EDWC) µg/l | |
|---|---|---|---|
| inches | meters | Existing | Proposed |
| 2 | .05 | 136 | 109 |
| 3 | .076 | 97 | 77 |
| 4 | .10 | **76** | **61** |
| 5 | 0.127 | 61 | 49 |

Abbreviations: DWA = drinking water assessment; kg = kilogram; ha = hectare; A = acre; a.i. = active ingredient

1. Rice paddy depth was converted from inches to meters to be used as the input parameter of the Tier I Rice model.
2. The Tier I Rice model scenario represents the existing label sequential application of 0.288 and 0.207 lbs. a.i./ A/yr versus the proposed single application rate of 0.36 lbs. a.i./ A/ yr.

### 5.2.2 Ground Water

Cyhalofop-butyl residues in ground water have been modeled in two previous drinking water assessments. Results from both model analyses concluded that exposure in ground water is low (up to 0.016 µg/l) (USEPA, 2001a and 2008). Consequently, ground water modeling using SCI-GROW was not repeated in this assessment.

## 5.3 Monitoring Data

Pesticide exposure monitoring is often conducted for purposes other than characterizing exposure from a particular pesticide (*e.g.* compliance). Consequently, monitoring data can be used to complement modeling data rather than to refine it. In general, a useful interpretation of monitoring values requires in-depth assessment of the data, which is beyond the scope of a Tier I assessment.

### 5.3.1 Surface Water

*Sources of Data*

Table 5-5 summarizes public agency water quality pesticide monitoring programs assessed. Only California Department of Pesticide regulation (CalDPR) had monitoring data to evaluate.

**Table 5-5. Sources of surface water monitoring data.**

| Agency | Program | Reference | Date Accessed |
|---|---|---|---|
| California Department of Pesticide Regulation (DPR) | Surface Water Database | http://www.cdpr.ca.gov/docs/emon/surfwtr/surfdata.htm | March 1, 2012 |
| United States Geological Survey (USGS) | National Water-Quality Assessment (NAWQA) Program Data Warehouse | http://water.usgs.gov/nawqa/ | March 14, 2012 |
| United States Geological Survey (USGS) | National Stream Quality Accounting Network (NASQAN) program | http://water.usgs.gov/nasqan/ | March 1 & 2, 2012 |
| US Environmental Protection Agency (USEPA) | STORET Database | http://www.epa.gov/storet/dbtop.html | March 1, 2012 |

*California DPR*

The California Department of Pesticide Regulation maintains a Surface Water Database containing data from a wide variety of environmental monitoring studies designed to test for the presence or absence of pesticides in the state's surface waters. Pesticide monitoring data were obtained from the state's website and evaluated for detections of cyhalofop-butyl in the state's surface waters and summarized in Table 5-6. During the period 2006 through 2008, water quality monitoring data for cyhalofop-butyl, for which data was available, indicate that cyhalofop-butyl was not detected in any of the 46 samples analyzed.

**Table 5-6. Detection levels of cyhalofop-butyl reported by California DPR's surface water pesticide monitoring program.**

| Year | Counties | Sample Locations | Sampling Period | Sample Events | Samples Reported | Level of Quantitation (µg/L) | Reported Concentration Cyhalofop-butyl Range (µg/L) |
|---|---|---|---|---|---|---|---|
| 2006 | Colusa, Sutter and Yolo | 5 | August 1 - September 20 | 2 | 7 | 0.05 | 0.0 – 0.0 |
| 2007 | Colusa, Sutter Yolo and Yuba | 5 | April 24 - September 18 | 6 | 30 | 0.05 | 0.0 – 0.0 |
| 2008 | Colusa, Sutter, Yolo and Yuba | 5 | April 13 - September 16 | 4 | 9 | 0.1 – 0.13 | 0.0 – 0.0 |
| | | | **Total:** | **12** | **46** | | **0.0 – 0.0** |

*Dow AgroSciences*

Dow AgroSciences submitted a study entitled "Surface water monitoring of cyhalofop-butyl in a California rice growing region in 2001," (MRID 45573201). Surface water monitoring was conducted weekly on Thursdays from May 24 to August 9, 2001. Application began on May 4, about three weeks before the monitoring began. Samples were collected from the Cross Canal where it enters the Feather River at State Highway 99. Dow states that this sampling site integrates drainage from the five-county area where application of cyhalofop-butyl was allowed under the Section 18 registration (155,000 acres in Hydrologic Catalog Unit number 180201109).

According to California Pesticide Use Reports, 788 lbs of cyhalofop-butyl was applied to 2,688 acres of rice in the monitored watershed (Sacramento River) in 2001. Results were initially reported for cyhalofop-butyl and cyhalofop-acid with detection limits of 0.5 ppb. Storage stability studies were submitted; however, the laboratory method was not independently evaluated. The water samples were re-analyzed for cyhalofop-amide and cyhalofop-diacid. No detections of any analyte were reported (Knuteson and Shackelford, 2001 and EPA, 2008).

*Drinking Water Study*

Monitoring samples were collected biweekly between May and July, 2002, at two community water systems in Sacramento, downstream from where cyhalofop-butyl was applied to rice fields. Cyhalofop-butyl and its transformation products were found between the levels of detection (0 .04 µg/l) and quantification (0.1 µg/l) in only one sample in the study; the rest of the samples were below the LOD. It is difficult to assess whether the sampling intervals were frequent enough to adequately detect the test material in the drinking water. Weather information and stream flow data were not reported. It is not known whether precipitation events occurred during the sampling period that may have affected concentrations of the test material at the test sites. Monitoring reflects cyhalofop-butyl applications to rice as a result of a Section 18 special exemption (Krieger, 2003).

### 5.3.2 **Ground Water Monitoring**

A review of publicly available ground water monitoring data was conducted of the California Department of Pesticide Regulation and the Agency's STORET database. A review of the data reveals that cyhalofop-butyl was not reported, and likely not sampled in California's monitoring regimes.

**Table 5-7. Sources of ground water monitoring data.**

| Agency | Program | Reference | Date Accessed |
|---|---|---|---|
| California Department of Pesticide Regulation (DPR) | Ground Water Database | http://www.cdpr.ca.gov/docs/emon/grndwtr/wellinv/wirmain.htm | March 2, 2012 |
| US Environmental Protection Agency (USEPA) | STORET Database | http://www.epa.gov/storet/dbtop.html | March 1, 2012 |

## 6.0 Drinking Water Treatment

Little information is available on the effect of drinking water treatment on cyhalofop-butyl and its degradates. Softening of drinking water will generally result in an increase in pH and could result in hydrolysis of the butyl to the acid (EPA, 2001b).

## 7.0 Literature Cited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